

CLAIMS

1. A producing method of a photomask on which a pattern to be transferred through a projection optical system under a predetermined first condition is formed, characterized in that

a parent pattern obtained by enlarging the pattern is formed on a first substrate, thereby forming a master mask, and

the parent pattern of the master mask is transferred onto a second substrate through a reduction projection optical system under a second condition set in accordance with the first condition, thereby forming the photomask.

2. A producing method of a photomask on which a pattern to be transferred through a projection optical system under a predetermined first illumination condition is formed, characterized in that

a parent pattern obtained by enlarging the pattern is formed on a first substrate, thereby forming a master mask, and

the parent pattern of the master mask is transferred onto a second substrate through a reduction projection optical system under a second illumination condition set such as to

compensate a variation in a projection image under the first illumination condition, then by forming the photomask.

3. A producing method of a photomask as recited in claim 2, characterized in that

the first illumination condition is illumination having a coherence factor of equal to or more than 0.7 or circular zone plate illumination, and

the second illumination condition is illumination having a coherence factor of equal to or less than 0.4 and equal to or more than 0.1.

4. A producing method of a photomask as recited in claim 2, characterized in that

the first illumination condition is illumination having a coherence factor of equal to or less than 0.4 and equal to or more than 0.1, and the second illumination condition is illumination having a coherence factor of equal to or more than 0.7 or circular zone plate illumination.

5. A producing apparatus of a photomask on which a pattern to be transferred through a projection optical system under a predetermined first illumination condition is formed, characterized by comprising:



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a third step of transferring an optical image obtained by reducing a pattern of the master mask  $1/\beta$  times under a second illumination condition set such as to compensate a variation in a projection image by the first illumination condition, onto a second substrate to form a working mask; and

a fourth step of transferring an image obtained by reducing a pattern on the working mask  $1/\alpha$  times under the first illumination condition onto the third substrate.

7. A producing method of a photomask having a pattern to be transferred onto a light-sensitive substrate by an exposure apparatus used for producing a device, characterized in that

a master mask on which at least a portion of a parent pattern obtained by enlarging the pattern is to be formed is disposed at an object plane side of a projection optical system, the master mask is illuminated under an illumination condition according to a proximity degree of the at least the portion of the parent pattern, and a reduced image of the at least the portion of the parent pattern is transferred through the projection optical system onto a photomask-producing substrate disposed at an image plane side to produce the photomask.

8. A producing method of a photomask as recited in claim 7, characterized in that the illumination condition is set such that the exposure apparatus and proximity effect are of opposite characteristics.

9. A producing method of a photomask as recited in claim 7, characterized in that the illumination condition is set such that at least one of a shape and a size of intensity distribution of the illumination light on a Fourier-transform plane with respect to a pattern plane of the master mask in an illumination optical system which illuminates the master mask with illumination light is brought into a predetermined state.

10. A producing method of a photomask as recited in any one of claims 7-9, characterized in that, the parent pattern is divided and formed in at least two regions, and reduced images of the at least the two regions are stitched and transferred onto the photomask-producing substrate.

11. A producing apparatus of a photomask having a pattern to be transferred onto a light-sensitive substrate by an exposure apparatus used for producing a device, characterized by comprising:



12.

15. A device characterized by being produced using the device producing method as recited in claim 6.